FAA National Software Conference, May 2002
Integrated Modular Avionics (IMA)

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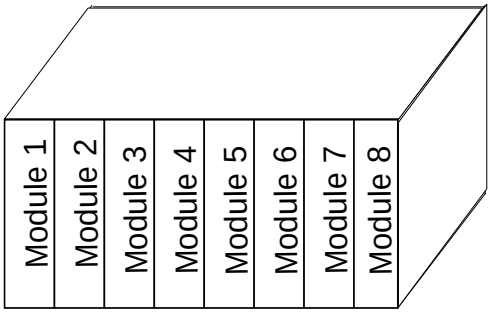

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Acronyms

AC	**Advisory Circular**
ASTC	**Amended Supplemental Type Certificate**
ATC	**Amended Type Certificate**
CAST	**Certification Authorities Software Team**
CM	**Configuration Management**
FAA	**Federal Aviation Administration**
FLS	**Field-Loadable Software**
GPS	**Global Positioning System**
HW	**Hardware**
ID	**Identification**
IMA	**Integrated Modular Avionics**
MPS	**Minimum Performance Standards**
P/N	**Part number**
SC	**Special Committee**
STC	**Supplemental Type Certificate**
SW	**Software**
TC	**Type Certificate**
TSO	**Technical Standard Order**
WG	**Working Group**

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Presentation Overview

- IMA Activities
- FAA's Technical Standard Order (TSO) on IMA Hardware Elements
- FAA's Advisory Circular (AC) on IMA Systems That Use Hardware Elements
- RTCA's New Special Committee (SC-200)

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IMA Activites

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IMA Activities

	ACTIVITY	PRODUCT(S)
	SC-182/WG-48	DO-255, Avionics Computer Resource Requirements
	FAA's IMA Team	TSO and AC for IMA Hardware Elements
To Become Joint Effort	EUROCAE's WG-60	Guidance Document(s) on Platform Development and Approval
To Become Joint Effort	RTCA's SC-200	Same as WG-60

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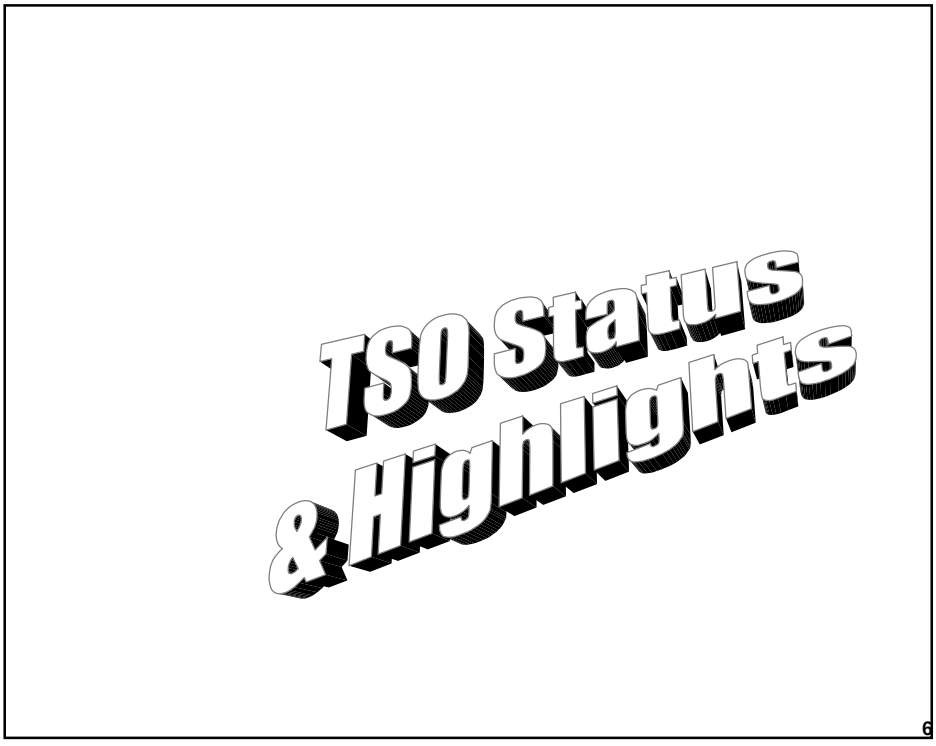

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TSO Status

- **Title: "TSO-C153, INTEGRATED MODULAR AVIONICS HARDWARE ELEMENTS"**
- **Published in Federal Register – 12/01**
- **Addressed all public and FAA comments – 3/02**
- **Draft 8c – Nearly Ready for Publication**
- **Aiming for June, 2002 Completion**

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TSO Overview

- **Section 1 – Purpose**
- ***Section 2 – Applicability**
- ***Section 3 – Requirements**
- ***Section 4 – Marking**
- **Section 5 – Application data requirements**
- **Section 6 – Manufacturer data requirements**
- **Section 7 – Furnished data**
- ***Section 8 – Manufacturer data sheet**
- **Section 9 – Availability of references**
- **Appendix 1 – MPS criteria**
- **Appendix 2 – Example format for data sheet**
- **Appendix 3 - Definitions**

** = To be discussed further*

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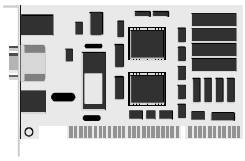
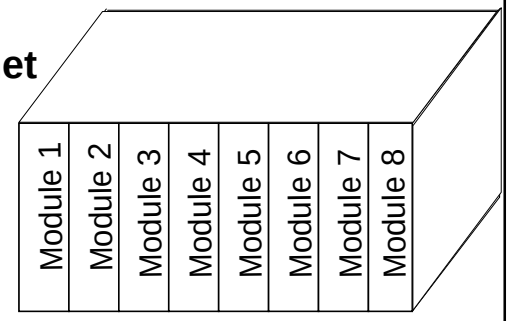
TSO Section 2 Highlights - Applicability -

- Hardware modules



- Rack/cabinet to host hardware modules



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TSO Section 3 Highlights - Requirements -

- a) Develop and meet MPS
  - Appendix 1 provides criteria for MPS
- b) Limitations:
  - No intentional transmitters
  - Only software to enable software loading and/or electronic part marking
- h) Support robust automatic configuration management system

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TSO Section 4 Highlights - Marking -

- Must comply with § 21.607.
- Additionally:
  - a) May mark hardware element with P/N in multiple places
  - b) May support electronic part marking
  - c) Hardware element may have software to enable field loading of software and/or electronic part marking
  - d) If (c) is true, may have separate hardware and software P/N
  - e) Must have unique part identification
  - f) Mark cabinet/rack with "TSO authorization for cabinet/rack only"

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TSO Section 8 Highlights - Data Sheet -

- Each hardware element should have a data sheet to summarize its characteristics
- Example format shown in Appendix 2
- Data sheet will become part of TSO authorization letter
- Data sheet will be supplied to all purchasers of the hardware element

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Some Unique Things About This TSO

- TSO is for "Brain Dead Hardware"
- Manufacturer Develops and Submits MPS to FAA
- TSO Provides Criteria to Be Addressed in the MPS
- Software Functionality is Limited
- TSO'd Hardware Elements May Support Functional TSOs
- Manufacturer Creates a Data Sheet to Aid Users

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AC Status

- Title: **"GUIDANCE FOR INTEGRATED MODULAR AVIONICS (IMA) THAT IMPLEMENT TSO-C153 AUTHORIZED HARDWARE ELEMENTS"**
- **Sent to FAA field offices – 12/01**
- **Addressed FAA comments 3/02**
- **Draft 9c – Nearly ready for Federal Register (FR)**
- **Aiming for 6/02 publishing in FR**
- **Aiming for 10/02 completion of AC**

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AC Overview

- **1 – Purpose**
- **2 – Related Docs**
- **3 – Definitions**
- **4 – Acronyms**
- ***5 – Scope**
- ***6 – Background**
- **7 – Document Overview**
- ***8 – IMA System Cert Overview**
- **9 – Safety Assessment**
- ***10 – Configuration Mgt**
- ***11 – Electronic ID**
- ***12 – Software**
- ***13 – Complex Hardware**
- ***14 – Design Guidance**
- **15 – Environmental Qual**
- **16 – Human Factors**
- ***17 – Testing (multiple levels)**
- ***18 – Roles & Responsibilities**
- ***19 – Third Party Guidance**
- ***20 – Airworthiness**
- ***21 – Maintenance & Continued Airworthiness**

**** Items to be discussed further***

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AC Sections 5 & 6 Highlights - Scope & Background -

- Guidance addresses multiple stakeholders (i.e., C153 TSO applicants, Functional TSO applicants, TC/STC/ATC/ASTC applicants)
- Guidance needed for compliance to regs when using C153 TSO'd hardware elements
- Guidance addresses the IMA system

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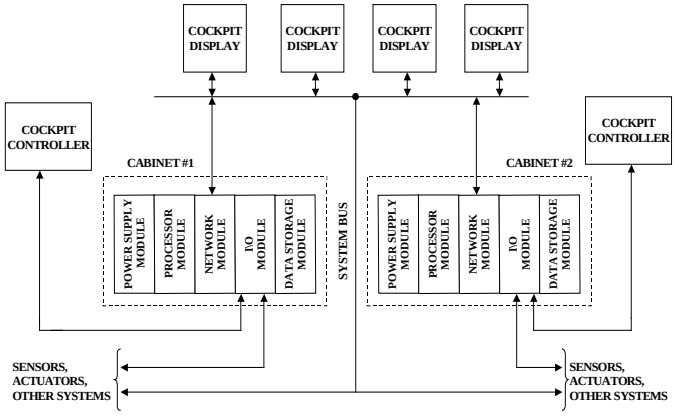
AC Sections 5 & 6 Highlights (cont) - Scope & Background -



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AC Section 8 Highlights
- IMA System Overview -

- Three Kinds of Approval
  - TSO-C153 Authorization
  - Functional TSO Authorization (e.g., GPS, Autopilot)
  - Aircraft Installation Approval (i.e., TC, STC, ATC, or ASTC)

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AC Section 10 Highlights
- Configuration Management -

- a) Many potential configuration management (CM) issues
- b) Robust automated CM system required:
  - Guarantee proper SW load
  - Identify improper system configuration
  - Annunciate “out of config” or “no dispatch” to crew
  - Means to verify proper SW & HW load
- e) Verification of correct SW load should not rely on a single action

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AC Section 10 Highlights (cont)
- Configuration Management -

- f) Changes to IMA SW or HW:
  - All SW changes to be tracked by automatic CM system
  - Major HW changes to be tracked by automatic CM system

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AC Section 11 Highlights
- Electronic ID -

- b) SW P/N must be verifiable through electronic query
- b) Improper config of SW should annunciate “no dispatch” to crew
- c) Electronic TSO nameplate meets 21.607 when:
  - P/N is stored in non-volatile memory
  - P/N is verifiable on ground at any geographic location

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AC Section 11 Highlights (cont)
- Electronic ID -

- f) All HW elements that support a functional TSO must have a physical nameplate (either C153 or functional TSO)
- h) Separate process to record IMA configuration is required

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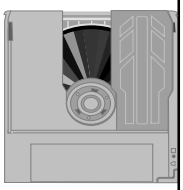
AC Section 12 Highlights
- Software -

- c. Field-Loadable Software (FLS)
  - Based on Notice 8110.77 & 8110.95
- d. Partitioning and Protection
  - Based on CAST paper and DO-248B discussion paper
- e. Software reuse
  - Based on Notice 8110.97



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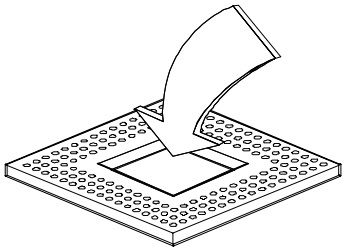
AC Section 13 Highlights
- Electronic Hardware -

- Invokes RTCA/DO-254 (or other acceptable means of compliance) for electronic devices whose functions cannot feasibly be evaluated by test and/or analysis.



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AC Section 14 Highlights
- IMA Design Guidance -

- a. Electrical power
- b. Reset features
- c. Built-in-test
- d. Maintenance diagnostics
- e. Failure detection and annunciation
- f. Functional partitioning
- g. Functional isolation
- h. Intentional transmitters
- i. Alerts and aural warnings

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AC Section 17 Highlights
- Testing Practices -

- Focuses on IMA-unique aspects of testing
- a. IMA Hardware Element Testing
- b. Individual System Testing
- c. IMA System Integration Testing
- d. Aircraft Ground Testing
- e. Aircraft Flight Testing
- f. Configuration Control During Flight Testing

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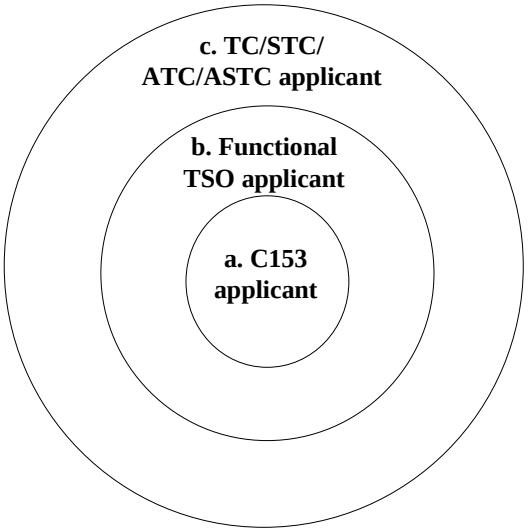
AC Section 18 Highlights
- Roles & Responsibilities -



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AC Section 18 Highlights (cont) - Roles & Responsibilities -

- C153 Applicant
  - Develop MPS (using Appendix 1 of TSO-C153)
  - Show compliance to MPS
- Functional TSO Applicant
  - Design system to comply with applicable TSOs
  - Address integration issues
  - Test to meet functional TSO

AC Section 18 Highlights (cont) - Roles & Responsibilities -

- TC/STC/ATC/ASTC applicant
  - Bulk of AC is their responsibility
    - Sections 9-17 & 19-20
  - TC/STC/ATC/ASTC applicant is responsible for pulling it all together

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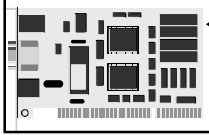
AC Section 19 Highlights
- Third Party Modules -

- Third party modules are those installed in C153 authorized rack/cabinet that are developed by a different manufacturer than the rack/cabinet
- Third party modules must meet environmental, interoperability, configuration management, & regulatory requirements
- Third party modules must participate in automatic configuration management system
- Data sheets should be provided for all third party modules



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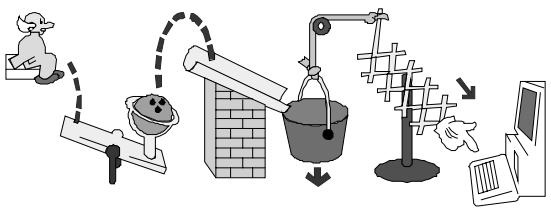
AC Sections 20 & 21 Highlights
- Airworthiness & Maintenance -

- Addresses Change Impact Analysis
  - Based on Notice 8110.85 concept
- Limits Usage of FAA Form 337 for IMA systems



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SC-200 Background

- RTCA Ad Hoc Meeting on Modular Avionics – 1/02
  - Determined Need for SC-200
  - Draft Terms of Reference
- SC-200 Approved by RTCA – 3/02
- First SC-200 Meeting – 5/02
- Plan to join with EUROCAE WG-60

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SC-200 Terms of Reference

- Propose and document means to certify (or approve) the modular avionics platform and its enabling components independent of the operational application; including consideration for installation in all categories and classes of aircraft.
- Identify specific modular avionics issues in current regulatory materials and industry practices, and recommend solutions.
- Propose and document a method for transferability of certification credit between stakeholders (e.g., aircraft manufacturer, system integrator, multiple application providers, platform provider, operators, regulators).

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SC-200 Terms of Reference (cont)

- Create guidance to address the following safety and performance issues (at a minimum):
  - Partitioning & Resource Management
  - Fault Management & Health Monitoring
  - Safety & Security
  - Flight Operations & Maintenance
  - Environmental Qualification
  - Configuration Management
  - Assurance
- Coordinate SC products with certification authorities (via Certification Authority Software Team or other appropriate groups).
- Support certification authorities to concurrently create implementation documents (e.g., TSO or AC).

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SC-200 Terms of Reference (cont)

- Establish close working relationships with EUROCAE WG-60, with the intention of producing common guidance.

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Summary

- TSO & AC support a "pseudo" IMA
  - TSO is ready for final publication
  - AC is nearly ready for publication in Federal Register
- SC-200/WG-60 will address "full-up" IMA
- All comments are welcome:
  - Send to: Leanna.Rierson@faa.gov and John.Lewis@faa.gov
- Thanks to all of you who have provided input!

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